Post-print version

This manuscript was published as:

Cornillie, F., & Desmet, P. (2016). Mini-games for language learning. In L. Murray & F. Farr (Eds.), *Routledge Handbook of Language Learning and Technology*. Routledge.

Chapter 'Mini-games for language learning' (section five)

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ABSTRACT

Mini-games for language learning are technology-based activities [a] that are intended to improve learners' mastery of specific linguistic constructions, [b] which afford explicit, form-focused, bite-size, and often fast-paced language practice, [c] which offer immediate feedback on learners' responses, and [d] that are *goal-directed* in the sense that learners pursue non-linguistic goals in addition to practising their language skills. From a theoretical perspective, such mini-games merit attention for two reasons. First, in Second Language Acquisition (SLA) venues, interest in the theoretical implications of practice has amplified in recent years (e.g. DeKeyser, 2007), and the investigation of mini-game-based practice using methodologies specific to the field of CALL (such as the automated logging of response times in learner performance) may likely yield novel insights into the development and nature of linguistic knowledge gained through practice, and into the roles of task conditions and consistent corrective feedback. Secondly, research on mini-games may shed light on the affordances of designed environments for sustaining learners' engagement in language practice, more specifically on the potential of narrative, non-linguistic goals, and positive feedback. Notwithstanding the theoretical justifiability of language learning mini-games, the empirical research is rather scant to date, and the current widespread support for communicative

language pedagogies may seem to defy usage of mini-games in classrooms. This contribution is intended to form an accessible, yet comprehensive and interdisciplinary introduction into the concept and affordances of mini-games, and advocates [1] theory-grounded, evidence-based, and user-centred design of such games, [2] their thorough evaluation for use in classrooms, and [3] their investigation within an architecture of human cognition which is known as Skill Acquisition Theory in the SLA literature.

SECTION 1: WHAT ARE MINI-GAMES FOR LANGUAGE LEARNING, AND HOW CAN THEY BE POSITIONED WITHIN THE BROADER AREA OF 'DIGITAL GAME-BASED LANGUAGE LEARNING'?

We define *mini-games for language learning* as technology-based activities [a] that are intended to improve learners' mastery of specific linguistic constructions in a second or foreign language (L2), [b] which afford explicit, form-focused, bite-size, and typically fast-paced practice, [c] which offer immediate feedback on learners' responses, and [d] that are goal-directed in the sense that learners pursue non-linguistic in addition to practising their language skills. Such goal-direction may be supported—first, and more typically—by extrinsic mechanisms and reinforcement (such as points and rewarding systems), or—potentially in more interesting ways—goal-direction may be enabled by design attributes associated with gaming that have a more intrinsic appeal, such as story, game cores, and positive failure feedback. In either case, non-linguistic goal-direction is intended to catalyse learner motivation and, consequently, to increase the time learners spend on L2 practice tasks. This definition is based on a comparative review of mini-games and on related literature in the fields of Second Language Acquisition (SLA) and (educational) game design, and will be unpacked in the remainder of this section.

Mini-games have been around since the early days of research, development, and practice in the field of Computer-Assisted Language Learning (CALL) (e.g. Stevens, 1984). Yet, two fairly current evolutions have spawned new potential for mini-games as effective tools for the development of skills in a L2: first, the steep rise and democratization of mobile technologies and the coinciding commercial success of games that are distributed through mobile devices; secondly, the renewed emphasis in SLA research on the dynamic interaction between explicit and implicit knowledge and the relevance of instructional strategies that focus learners' attention on formal aspects of language (e.g. Ellis, 2005; Hulstijn, 2002), including explicit instruction followed by systematic practice (e.g. Gatbonton & Segalowitz, 2005; Ranta & Lyster, 2007). In the rest of this section, we will first position mini-games for language learning with respect to other types of games used in L2 teaching and learning (L2TL), and will then elaborate on the practical benefits and design attributes of mini-games.

1.1. Situating mini-games within digital game-based language learning

Games are notoriously complex expressions of human creativity and culture, and often defy categorization. Nonetheless, a high-level typology may help to situate the many types of games with respect to one another. In the area of digital game-based language learning (DGBLL), such a typology can aid to comprehend the various approaches that are being taken to use games in order to support L2TL. Here, we distinguish between two dimensions that may frame mini-games in the area of DGBLL, namely their relation to situated avatar-based games, and their primary design purpose.

1.1.1. Relation to situated avatar-based games

A first dimension that helps to position mini-games within DGBLL is the relation of mini-games with what we will henceforth call *situated avatar-based games*. Situated avatar-based games

typically figure large open worlds in which players have much freedom to explore and take action. They include storylines to give a sense of purpose to the player's actions, represent a personification of the player in the form of an avatar, and thus cast the player as a character in a story. Examples of the latter include game genres such as interactive fiction/text adventure games, and the more recent popular genre of Massively Multiplayer Online Roleplaying Games (MMORPGs), such as *World of Warcraft*, in which many players collaborate and compete with each other simultaneously in a vast fictional (typically 3D) space. Mini-games, by contrast, are much more constrained, and come in formats such as puzzles, quizzes, arcade, or dress-up activities. They usually feature simple gameplay and can be played in short amounts of time. For this reason, they are considered examples of 'casual games' (Mawer & Stanley, 2011). Although the difference between mini-games and situated avatar-based games is not absolute, these game types may be distinguished from one another in terms of design attributes, complexity of the skills involved in playing, contextual characteristics, and affordances for L2TL.

First, on the level of design, the prefix 'mini' implies that mini-games are constrained, and are narrower in scope than situated avatar-based games. They lack the openness which typifies situated avatar-based games, and do not feature extensive storylines or a personification of the player. Further, mini-games can be embedded within a situated avatar-based game, and may influence how play of such a game evolves. Section 1.3 discusses the design attributes of mini-games in more detail.

Secondly, in comparison with a situated avatar-based game, a mini-game involves simple rules and is usually easy to operate. Hence, playing a mini-game requires only basic problem-solving and simple cognitive-motor skill, and mini-games are typically played in short bursts. Situated avatar-based games require more commitment from the player in terms of skill and time investment.

Further, mini-games differ from situated avatar-based games in terms of contextual features including number of players simultaneously involved, required hardware, production costs, and target audiences. Gameplay of mini-games typically involves only one player, whereas situated avatar-based games usually involve multiple players in competition or collaboration. On a technological plane, mini-games can be played on relatively low-end and low-cost devices such as mobile phones, whereas situated avatar-based games are developed using state-of-the-art 3D technologies and demand more advanced hardware configurations—yet, the gap between both types of games in terms of required hardware seems to be narrowing, as computing power and screen real estate of mobile devices are ever increasing. Also, mini-games are produced on lower budgets than situated avatar-based games, as the development of both technology and content require less effort. Further, we may distinguish mini-games from situated avatar-based games in terms of target audiences. Popular wisdom has it that situated avatar-based games appeal mainly to (the stereotype of) the 'hard-core gamer'. Arguably, mini-games have a wider target audience, and may also attract people that are less accustomed to gaming.

Finally, and most importantly, mini-games have different affordances for L2TL than situated avatar-based games. Because of their casual nature and more constrained scope, they appear to be particularly suitable for focused practice of enabling L2 skills (i.e. knowledge of vocabulary, grammar, spelling, or pronunciation). Situated avatar-based games, in general, make better candidates for more holistic practice of the four major L2 skills (reading, listening, speaking, and writing) as well as for the development of intercultural and social skills. From the perspective of task-based language teaching (R. Ellis, 2003), situated avatar-based games would seem useful for language practice with *tasks,* in which learners must use the L2 meaningfully and communicatively in an attempt to obtain a certain non-linguistic (communicative) outcome, whereas mini-games appear similar to *exercises*, i.e. pedagogical activities that do not result in a non-linguistic outcome, but which are intended to help learners develop understanding of a

specific linguistic aspect. In section 2, we will expound on the affordances of mini-games from the perspective of SLA theory.

1.1.2. Primary design purpose

A second dimension that helps to frame mini-games for L2 learning within DGBLL concerns the primary design purpose of a mini-game, i.e. how the designer of a particular game intended it to be used. The primary design purpose may be either to educate or to entertain. This relates to a sub-field of CALL known as *tutorial CALL* (Hubbard & Bradin Siskin, 2004), i.e. the research and development of computer-based activities that were designed specifically with L2TL in mind. Tutorial CALL software includes content that is tailored for L2 learners, controls the learning process according to a set of pre-programmed rules, evaluates the learner's linguistic responses, and gives automated corrective feedback. Tutorial CALL software has been contrasted with—and has of late been somewhat marginalized with respect to—software applications that were not designed with L2TL in mind (and hence lack specific linguistic-pedagogical features), but may nonetheless be repurposed for L2TL. Examples of the latter are e-mail, wikis, voice-over-IP tools, and software for social networking.

In the area of DGBLL, this distinction also emerges, and relates to whether a particular game that is being used in L2TL was specifically engineered for L2 learning and for supporting the L2 learning process, or whether it was primarily designed for entertainment purposes. In recent years, CALL researchers have developed different labels for this dichotomy. Cornillie, Thorne, & Desmet (2012) built on terms from the (early) CALL literature and from the more general game-based learning literature, and proposed the labels *tutorial CALL games* and *(commercial) off-the-shelf games* to respectively refer to games that were specifically devised for the purpose of language teaching and learning, and to games that were designed for the purpose of

entertainment. Reinhardt & Sykes (2012) put forward the terms *game-based learning* (working with educational and L2 learning purposed games) and *game-enhanced learning* (the use of vernacular games). Whatever the labels used, the major pedagogical differences between both types of games are that tutorial CALL games focus on power genres of L2 use (i.e. varieties of the L2 that are usually taught in classrooms and institutionalized curricula) and have linguistic-pedagogical assessment and support strategies (such as corrective feedback) built into the system. Playing off-the-shelf games, on the other hand, often involves the use of less canonical L2 registers—or sometimes does not even require use of the L2—and because these games do not monitor the learner's speech or give linguistic support, their implementation in L2 classrooms more strongly demands pedagogical support from teachers or peers prior to, during, or subsequent to play in order to raise learners' (meta-)linguistic awareness and perhaps speed up the L2 learning process.

To illustrate this distinction in the area of mini-games, we refer to a pedagogical implementation of an off-the-shelf mini-game devised by the authors of the teacher development book *Digital Play* (Mawer & Stanley, 2011). The off-the-shelf game, called *Orbox*, requires the player to navigate a ship to a target in a two-dimensional space by pressing the arrow keys without flying off into deep space. By itself, the game is not interesting for L2TL—it does not even involve language—but the language teacher can make the activity pedagogically useful by repurposing it for the L2 classroom, namely by creating an information gap between two learners, which necessitates their use of language. On the website that accompanies Mawer and Stanley's (2011) book, a lesson plan is given on how this game could be used for drilling the topic 'giving and understanding directions' in pairs, with one learner looking at the screen and giving directions, while the other player executes the directions on the keyboard without looking at the screen. While the game may provide 'implicit', game-embedded feedback if a learner gets any of the

directions wrong, it gives neither feedback on linguistic form nor remediation, but the teacher may give such linguistic support on an as-needed basis.

A tutorial version of the topic 'drilling directions', then, could be a simulation of taxi driving. The learner first plays the driver and executes directions given by a virtual client (listening), and then plays the client who follows his preferred route visualized on the screen (speaking). If the learner experiences problems, the system provides corrective feedback, as well as a link to a list of useful phrases with target pronunciations (possibly accompanied by translations in the mother tongue). For each learner, the system keeps track of the number and type of mistakes per linguistic construction, and perhaps performs an error analysis, on the basis of which new routes can be generated (to be offered as remediation). Increasing time pressure, various routes from one point to another, and perhaps unexpected obstacles as the taxi is approaching its destination, keep such a game interesting. Finally, the system can provide corrective feedback adapted to the theme of the game: deviating from the route (e.g. pressing the left key or saying 'to the left' rather than pressing the right arrow key or saying 'to the right') would cost fuel, or perhaps clients.

Some language teaching innovators like Mawer and Stanley have advocated the implementation of off-the-shelf games in the L2 classroom rather than the use of tutorial CALL games, arguing that the latter are often not much fun and mostly feel like "thinly disguised tests" (2011, p. 15). We share the critique that tutorial CALL games haven't lived up to expectations, and will argue further in this chapter that the key to making them successful is not to disguise language instruction and practice in elements of game design, but to make instruction at the same time explicit and purposeful/relevant for L2 learners (see sections two and four).

1.1.3. Four broad categories of games for L2TL

On the basis of these two dimensions, we can distinguish the following four broad categories of games to support L2 learning: mini-games designed for L2TL purposes; off-the-shelf mini-games; situated avatar-based games that were designed for L2TL, also called *synthetic immersive environments* (Sykes, Oskoz, & Thorne, 2008); and off-the-shelf situated avatar-based games. Table 1 provides examples for each of these categories.

TABLE 1: EXAMPLES OF DGBLL ACCORDING TO TWO DIMENSIONS

	mini-games	**situated avatar-based games**
designed for L2TL (tutorial)	*Johnny Grammar's Word Challenge* (British Council); the *MindSnacks* series of apps	*Tactical Language and Culture Training System* (W. L. Johnson, 2007)
off-the-shelf	*Orbox* game (Mawer & Stanley, 2011)	*World of Warcraft*

When we use the term 'mini-games' in this chapter, we refer mainly to mini-games designed for L2 learning purposes (i.e. tutorial mini-games). In what follows, we will argue that such games offer unique practical benefits for classroom L2 teaching (see section 1.2), as well as a number of affordances for the L2 learning process which may be theoretically justified (see section 2).

1.2. Practical benefits of mini-games for L2 learning

The practical benefits of mini-games for L2 learning are threefold. First, in comparison with situated avatar-based games, mini-games may be cheaper alternatives for introducing gaming in L2 learning curricula. Game developers are working on methods to reduce the production and distribution costs of (immersive) situated avatar-based games, also with a view to making their technology more affordable for educational purposes (e.g. Hollemeersch et al., 2010). Still, the implementation of such games in classrooms remains relatively expensive. Moreover, the

development of immersive avatar-based games specifically for L2TL comes with serious design challenges. As a result, examples of such games that have been successfully adopted in a language training curriculum are few.

Secondly, because the content in off-the-shelf games is typically not adapted to or integrated in L2 teaching curricula, teachers may either be reluctant to using them in class, or may have a hard time selecting appropriate ones—for an excellent guide on pedagogically appropriate uses of off-the-shelf games in the language classroom, see Mawer & Stanley, 2011. Mini-game technology may offer materials designers, teachers, or even learners templates with which they can easily author content that is suitable for L2TL.

Third, in instructed L2 learning, teachers may have insufficient resources to pay close attention to learners' individual performance while they work with games and to provide individualized support, including timely, consistent feedback. One of the major benefits of tutorial mini-games for L2TL is that learner performance can be measured in automated ways and linguistic support can be tailored to individual needs.

1.3. Design attributes of mini-games for L2 learning: linguistic-pedagogical support and non-linguistic goal-direction

The most typical characteristics of mini-games for L2 learning are that they can be completed in a short amount of time and require little problem-solving and cognitive-motor skill. However, when we inspect mini-games in closer detail, we quickly see that they often have very different features. In this section, we present an overview of key design attributes, based on an exploratory comparative analysis of mini-games for L2 learning, and give brief descriptions of

these attributes. For more detailed discussion of these design attributes, as well as examples of and links to mini-games, we refer to a deck of slides that accompanies this chapter.

The design attributes of mini-games may be grouped in two sets, depending on their primary objective. A first set of attributes is primarily linguistic-pedagogical in nature (see Table 2). These attributes are intended to structure and support the L2 learning process while learners are interacting with mini-games.

TABLE 2: LINGUISTIC-PEDAGOGICAL ATTRIBUTES OF MINI-GAMES

Attribute	**Description**
Linguistic focus and learning aim	What the game focuses on from a linguistic point of view, and which enabling skills (knowledge of lexicon, spelling, grammar) and main skills (reading, writing, listening, or speaking) are addressed.
Context and meaning focus	How the linguistic constructions are contextualized (decontextualized, contextualized at the level of the chunk or sentence, or as part of a story), and thus how the learner's attention is focused on meaning.
Response design	How the software constrains (the types of) responses that learners are allowed to give. Typically, mini-games have closed response designs, with selected response measures such as multiple choice, but more open response designs are also possible, such as typing or even speaking.
Item selection and sequencing	How particular items are selected and sequenced (and repeated) throughout practice. A popular sequencing technique in mini-games is the spaced repetition system designed by Leitner (Leitner, 1972), which repeats those items more often which the learner frequently answers incorrectly.
Learner control	To what extent the learner (rather than the system alone) may control aspects of practice, such as content or pace.
Assessment and feedback	How the game assesses performance and how it gives feedback ('knowledge of results' feedback, or more extensive linguistic explanation).

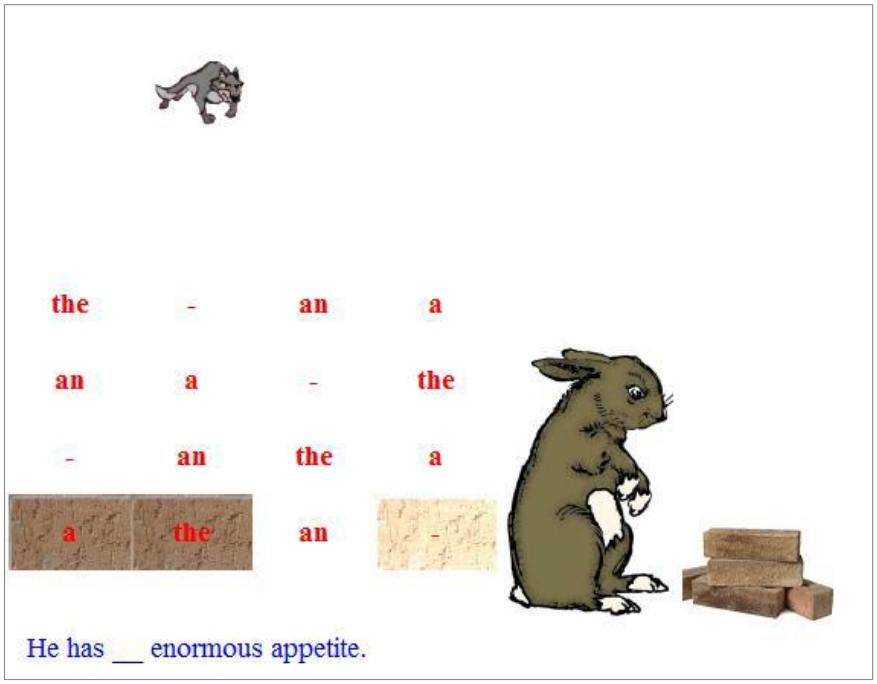

FIGURE 1: MINI-GAME *ARTICLE WOLF* (© BISCUIT SOFTWARE LTD),

PROVIDING FOCUSED PRACTICE OF ENGLISH ARTICLES IN THE MEANINGFUL CONTEXT OF A STORY

A second set of design attributes includes typical design elements of games or *game attributes* (see Table 3). These attributes are all somehow related to how learners are engaged in achieving non-linguistic goals, and hence are intended to increase the time learners spend on L2 practice.

TABLE 3: GAME ATTRIBUTES OF MINI-GAMES

Attribute	Description
Excessive positive feedback and rewarding	Feedback in response to desirable behaviour that is often disproportionate to the action required from the user; also called *juicy* feedback (Juul, 2010, p. 45). Examples are: points and excessive animations for single actions; *badges*, praise, etc. for longer-term performance.
Competition	Competition with oneself (personal best score), with artificially intelligent opponents, with other players, or between groups of players. Aggregation of highest scores on *leaderboards*.
Time pressure	Whether or not players need to compete with time while striving to complete objectives.
Fantasy	"Make-believe environment, scenarios, or characters" (Bedwell, Pavlas, Heyne, Lazzara, & Salas, 2012, p. 4) that are inherent in the format of the game (not in its content). An example is representing response options

	as balloons to pop. This term traces back to Malone's (1981) pioneering work on instructional games, and is not to be confused with the genre of fantasy games.
Game core and non-linguistic outcomes	The challenge that critically requires player involvement in the interaction (e.g. a language exercise linked to the fantasy of a fish in a leaking tank), and the non-linguistic outcomes that come with resolution of the challenge (e.g. saving the fish).
Positive failure feedback	Communication of failure (i.e. corrective feedback) that supports the player's motivation, for instance through engaging and varied animations. Typically contingent upon the fantasy of the game (e.g. the fish goes to heaven).
Story	Elements of narrative included in the content (items) of the game.

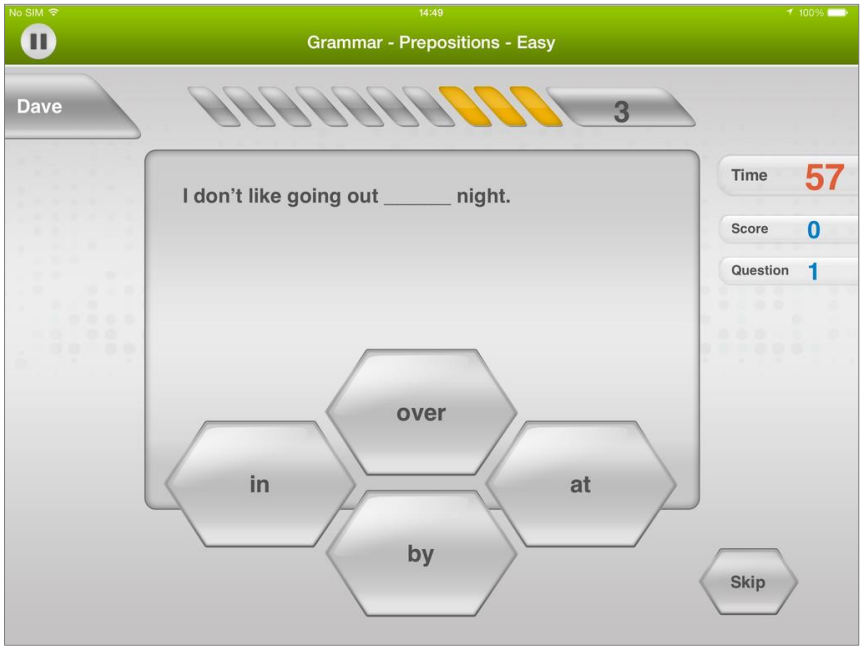

FIGURE 2: MINI-GAME *JOHNNY GRAMMAR'S WORD CHALLENGE* (© BRITISH COUNCIL), PROVIDING PRACTICE OF VOCABULARY AND GRAMMAR WITH TIME PRESSURE

We note two limitations of our typology. First, we note that the difference between these two types of attributes (linguistic-pedagogical and game attributes) is not absolute, and some attributes may belong to both categories. Secondly, we admit that there are more principled ways to identify design attributes than a comparative review of mini-games (see e.g. Bedwell et al., 2012 for a more rigid analysis of game attributes). However, we did not intend this typology to be exhaustive, and hope that it may be used as a first step towards a framework for designing

and evaluating mini-games for the purpose of L2TL. We invite readers to challenge this framework and to build upon the ideas presented here.

When designing mini-games for L2 learning, it may be tempting to implement as many design attributes as possible. Yet, what will work best is likely to depend to a large extent on the learning context and on the individual characteristics of learners. We will revisit this in section four.

SECTION 2: HOW CAN THE USE OF MINI-GAMES IN THE LANGUAGE CLASSROOM BE THEORETICALLY JUSTIFIED?

2.1. Mini-games in L2 pedagogy: a revival of drilling in disguise?

If we look at mini-games from the perspective of L2 pedagogy, they seem closely related to what has long been known as *drilling*, a concept that is used more or less interchangeably with the terms *(drill and) practice, pattern practice, focused/systematic/controlled practice*, and *focus on form**s*** (for the confusing distinction between the latter term and the concept *focus on form*, see Long, 2007, pp. 121–123). In its broadest sense, 'drilling' refers to activities in a L2 that focus on specific linguistic constructions and that involve a great deal of repetition, feedback, and often time pressure, with the goal of developing explicit knowledge about these constructions as well as skills in the L2 (DeKeyser, 2007).

Three types of drills have been distinguished (DeKeyser, 2007; Paulston & Bruder, 1976): mechanical, meaningful and communicative. Mechanical drills, by way of their design, permit only one correct response and do not require that the learner comprehends the meaning of the sentence in order to succeed at the task. The textbook example is entirely decontextualized

practice of verb conjugations. Next, there are meaningful drills, which also limit the range of responses fairly strictly, but demand that the learner comprehends the input on both a structural and a semantic level in order to succeed. Communicative drills, finally, require learners to draw on their own experiences and add new (unpredictable) information to the context provided by the teacher. In other words, in communicative drills, learners convey personal meaning. Further, irrespective of their type, drills can target comprehension skills or production skills, can be oral or written, and can focus on diverse formal aspects of the L2 (phonological, morphological, syntactic, or lexical form). Thus, the term 'drilling' has many faces, and covers a diverse range of activities for L2 practice.

However, 'drilling' and related terms have come to be used most commonly in their most narrow sense, namely as mechanical practice activities that focus exclusively on grammar in listening and speaking tasks, and in which learners "repeat sentences that are related only by the fact that they share some grammatical pattern" (Lightbown, 2008, p. 27). As is well known, such spoken pattern drills were strongly encouraged by audiolingualism, a method of language teaching that was quite popular in the mid-20th century. Its main objective was to help L2 learners develop (spoken) communicative ability. It was deeply rooted in structural linguistics and behaviourism (Skinner, 1957), and treated L2 learning as the result of a formation of habits, in which repetition and feedback played a significant role. Its main premise, then, was that if learners are engaged intensively in the habit of oral productive practice, they will acquire the skills that are implied in communicative competence. Hence, audiolingualism steered away from formal (grammar) instruction, but put oral pattern practice centre stage.

Since the communicative turn in language teaching methodology, the theoretical grounds of audiolingualism have been discredited, and empirical research has shown that the type of drilling that seems to have formed the flagship of the method (i.e. mechanical drilling) is

ineffective and sometimes even disadvantageous for the development of communicative L2 ability (for discussion see DeKeyser, 1998; Wong & VanPatten, 2003). Consequently, language teachers trained against the backdrop of communicative approaches usually eschew such drills, and by extension sometimes even meaningful and communicative drills. It remains open to investigation, however, whether drills of the latter two types are effective for L2 development.

Mini-games are similar to drills in a number of aspects: they focus on specific linguistic constructions, they involve a great deal of repetition and feedback, and there is a certain behaviourist ring to their reward mechanisms. Moreover, they are reminiscent of early CALL programs, many of which were faithful implementations of behaviourist principles (including reinforcement and punishment feedback). As a result of the apparent similarities between mini-games and drills, and of the narrow interpretation that drilling usually gets in L2 pedagogy, teachers may be sceptical about the utility of mini-games for L2 development. Such scepticism is probably justified for certain types and uses of mini-games. Yet, on the basis of current theory and empirical evidence in SLA, there is still support for many types and implementations of mini-games.

2.2. Mini-games in SLA theory: perspectives from Skill Acquisition Theory

Theoretical support for the potential usefulness of mini-games comes from SLA theories that focus on *automaticity*, which we define here as the effortless and quick retrieval of linguistic constructions (particular items/instances and more complex grammatical schemata) from long-term memory, largely without conscious attention. Such theories tally well with mini-games, because they emphasize the role of continued and consistent practice, ideally accompanied by feedback, for the development of automaticity. Of the various theories that have been proposed (see DeKeyser, 2001 for a review), we will zero in on Skill Acquisition Theory (SAT; DeKeyser,

1998, 2008), because it offers the greatest explanatory power for phenomena in L2 learning related to practice, as well as practical guidelines for the design and evaluation of mini-games for L2 practice.

SAT is a theory of L2 learning that is rooted in a more general theory of human cognition. Its main premise is that when becoming skilful at a certain task in the L2, learners move through a series of stages that differ with respect to [a] the effort with which learners perform the task and [b] the type of knowledge on which learners rely in order to perform the task. In the first stage of skill acquisition, learners develop *declarative knowledge* about something ("knowledge that"; also called *explicit knowledge*), such as the knowledge that countable nouns in English go with the quantifier *many*, or the knowledge that the concept [CAT] is expressed by the three-letter sequence *cat* which belongs to the semantic field [ANIMALS]. In the second stage, learners put this knowledge to use (e.g. *many cats*), which contributes to the building up of *procedural knowledge* ("knowledge how"; *implicit knowledge*). In the initial phase of proceduralization, the retrieval and application of declarative knowledge is effortful, which shows in learners' behaviour: it is error-prone and slow. Yet, procedural knowledge develops quickly, and its advantage is that the information becomes available as a ready-made chunk in memory, which speeds up retrieval. The last stage of skill acquisition involves the fine-tuning of procedural knowledge. This results, over time and with much practice, in automatic, fluent, and error-free performance of the particular skill, which is supposed to draw mainly on implicit knowledge (DeKeyser, 1998, 2008).

Thus, the advantage of skill learning is that over time, the skill (e.g. applying the rules for quantifiers in English) becomes automatized, which frees up attentional resources for higher-order thinking in more complex tasks (e.g. delivering a formal talk on your company's annual revenues). The downside of the process is that automatization is 'trapped in' a specific skill: it

does not transfer well to other skills (DeKeyser, 1997). In L2 development, the skill-specificity of automatization explains the phenomenon that a good L2 writer is not necessarily a fluent L2 speaker, and that learners trained according to audiolingualism are not necessarily good at communication in the L2—these learners are primarily trained in parroting form-form mappings rather than in conveying personal meaning. In order to promote transfer from one skill to another, SAT emphasizes the importance of similar task conditions (e.g. comprehension vs. production, oral vs. written) as well as declarative knowledge. Such abstract knowledge may help to bridge the differences between different tasks. Therefore, it needs to be taught explicitly in the beginning of the acquisition process, and needs to be repeated when performing the skill (i.e. during proceduralization and automatization), for instance through metalinguistic corrective feedback. SAT is known as a *strong-interface theory* of L2 learning: it posits that implicit/procedural and explicit/declarative knowledge are both relevant for L2 learning, and that explicit knowledge contributes to the development of implicit knowledge (see also N. C. Ellis, 2005; Hulstijn, 2002). Note that in SAT, declarative knowledge is important, but the theory also allows space for the incidental build-up of a procedural knowledge base without initial declarative knowledge (i.e. as the by-product of communication).

So, from the perspective of SAT, mini-games are promising. They offer opportunities for focused and continued practice of enabling skills, which is essential for the automatization of knowledge. They can deliver individualized, consistent, and just-in-time feedback, possibly accompanied by metalinguistic explanations. So, mini-games may constitute just those vital, highly focused, and potentially also motivating practice activities that SAT considers necessary for L2 development.

It is highly desirable, however, that mini-games move beyond the level of mechanical practice. There may be scope for mechanical mini-games in the initial stages of skill acquisition, namely in order to develop declarative knowledge. Yet, declarative knowledge is restricted: it is limited to

form-meaning mappings out of context (e.g. in the case of explicit vocabulary learning: [CAT] = *cat*) and sometimes even to form-form mappings (e.g. *many* goes with countable nouns). Since the essence of L2 learning is about learning to communicate—i.e. to produce form-meaning mappings that convey personal and situated meanings—instructional designers must come up with practice activities that force L2 learners to focus on the meaning of linguistic constructions, and that engage them in genuine communication. Meaningful and communicative practice supported by mini-games may, over time, help learners to develop knowledge that could transfer to their performance (accuracy, and possibly fluency) on complex, authentic language tasks. We will turn to the implications for practice and research in sections four and five.

SECTION 3: WHAT ARE THE KEY FINDINGS OF EMPIRICAL RESEARCH ON MINI-GAMES?

Empirical research on L2 learning with mini-games is scant. In this section, we highlight three key papers published through peer-reviewed venues that qualify as empirical studies on L2 learning with mini-games.

Stevens (1991) tracked first-year Arabic university students' problem solving strategies in a computerized version of the popular game *Hangman*, which comprised spelling practice of English words extracted from texts studied in their academic programme. Results show that students used strategies considered optimal for learning in half of the solved problems, compared to 92% of the solved problems in the case of ESL teachers, who were viewed as model learners. The authors did not investigate whether the different strategies used in the fairly mechanical practice tasks resulted in higher competence regarding orthographic combinations on complex transfer tasks subsequent to practice.

Stevens (1984) investigated the effect of learner control in computerized practice tasks on the development of knowledge about verb complements (gerund vs. infinitive). Control was

operationalized as having or not having the opportunity to choose (by using game paddles) the constructions to practise with and to vary the order of their presentation,. The participants were 24 learners of ESL. Development was measured as the difference between performance on a pre- and post-test (of which the design is not documented in this paper). Although the differences were insignificant, the learners with control outperformed those who had practised the constructions in a pre-determined choice and order. Interestingly, the former learners also spent less time solving the problems, as well as less time in the screen that contained explanation of the grammar rules. The author suggests that the learners who had control approached the sentences more out of a desire to explore their meaning than the other learners.

Strong empirical support for the usefulness of mini-games to further lexical development comes from Cobb & Horst (2011). Using the suite of mini-games shipped with the popular *My Word Coach* series designed for explicit vocabulary learning, the authors carried out an ecologically valid experiment with 50 young ESL learners in Canada. The various games focused both on form and on form-meaning connections. Growth was measured using a battery of pre-and-post-tests that targeted form recognition, meaning recognition, free production, and speed of lexical access. Two months of game use resulted in huge gains in recognition vocabulary in comparison with normal vocabulary growth, increased speed of lexical access, and more use of English words in a storytelling task. The study shows that intensive practice with mini-games helped to develop knowledge both at the declarative level (larger recognition vocabulary) and at the procedural level (faster access to already known words), and that the practice effect transferred to the more complex skill of storytelling. From the perspective of Skill Acquisition Theory, the latter result is particularly noteworthy, given the differences between the skill applied in practice (written comprehension) and the skill used in the follow-up storytelling task (spoken L2 production).

SECTION 4: WHAT ARE THE KEY CONSIDERATIONS WHEN DESIGNING OR EVALUATING MINI-GAMES FOR USE IN LANGUAGE LEARNING AND TEACHING CONTEXTS?

When designing or evaluating mini-games for use in L2TL, we recommend the following five-step cycle: a 360-degree and user-centred needs analysis, the provision of explicit instruction prior to play, creation of a purposeful context for practice, meaning-focused practice with mini-games, and communicative follow-up activities with space for a wide range of corrective feedback types. This cycle may be repeated in order to improve the instructional design.

Start with a 360-degree needs analysis of the learning and teaching context, covering linguistic needs, nature of the linguistic constructions, and learners' individual differences and their culture. First, identify linguistic needs on the basis of learners themselves, taking into account the register of the L2 in which the learners will be most active in out-of-class contexts. For instance, it makes little sense to teach and practise the difference between *less* and *fewer* if your learners will never need to write a formal text in English. Next, for grammar practice in particular, select constructions on the basis of their linguistic characteristics. There is reason to focus on grammatical constructions that have wide scope (i.e. apply to many cases), that are reliable (i.e. have few exceptions), and that are simple; other patterns may be more easily acquired through implicit learning (DeKeyser, 1998). Further, when selecting the games, consider a wide range of learner characteristics such as language aptitude ("Do learners have the necessary academic ability to work with grammatical concepts?"), age (younger learners may be more interested in repetitive games than older learners), and *achievement motivation* ("Are learners likely to be motivated by game attributes such as positive feedback, rewarding, or competition, or is a more intrinsic approach required?"). Finally, culture may play a role: language drills may be more readily accepted in some cultures than in others.

Next, any declarative knowledge needs to be pre-taught that is likely to help proceduralization and automatization of the skill. Depriving learners of such declarative knowledge equals the bad practice of hiding instruction in the ludic enjoyment of mini-games. This will be ineffective, and may even make learners frustrated during practice. This does not imply that grammar ought to be taught deductively: learners may be more motivated when they work out rules by themselves before the teacher explains them (Ranta & Lyster, 2007).

Then, set up a purposeful context for practice with mini-games, such as a (murder) mystery that needs to be solved. In the parlance of task-based language teaching, this will give learners non-linguistic outcomes to pursue, while working towards realizing language aims. What context is most powerful depends, again, on individual differences. However, in order to increase the chances that learners are engaged in meaningful rather than mechanical practice, an absolute requirement is that (the content of) practice with mini-games is embedded in authentic texts in the L2, such as a murder story. Progression in the mini-games could lead to the gradual unveiling of the mystery, which could both capture learners' interest and engage them in meaningful processing of the practice items.

Next comes focused practice with mini-games. The games may be varied, but need to generate opportunities for meaningful practice. Mechanical practice alone is not likely to result in better performance on more complex communicative tasks, so mini-games must be selected and designed that require learners to focus on the meaning of linguistic constructions, ideally with (semi-)open response designs. Communicative mini-games are highly desirable but can be challenging to design and develop, considering that learners may find typing cumbersome in games, and that human language technology (including automatic speech recognition) may not (yet) be sufficiently robust for handling learners' responses in (spoken) interaction. Further, the conditions of practice can be varied over time. Practice needs to start out without time pressure,

with linguistically simple utterances, and with little game element interactivity, so that learners have ample time and attention to apply and develop declarative knowledge. As learners get better, time pressure and the linguistic complexity of utterances could be increased, and additional game elements could be introduced in order to progressively increase cognitive demands during practice. Increasing the cognitive demands of practice steadily could both keep learners interested and provide fewer opportunities to spend attention on language form, which is considered a necessary step towards automatization (K. Johnson, 1994).

In order to realize transfer to other L2 skills, it is mandatory that practice is followed (and possibly also preceded; see Gatbonton & Segalowitz, 2005) by activities with a more communicative focus. For instance, learners could do role-plays and report on their investigation as detectives in a murder case, or play the suspects, using the linguistic constructions that were in focus during practice. Or, they could come up with alternative versions of the story, and rewrite (parts of) the text. Also at this point, teachers should not refrain from providing a wide range of corrective feedback types, on an as-needed basis and if necessary including metalinguistic explanation, in order to help learners realize transfer through declarative knowledge.

SECTION 5: SUGGESTIONS FOR FUTURE RESEARCH

In the investigation of the potential of mini-games for L2 development, a specific role for CALL research is to apply methodologies afforded by technology, such as logging and learner-centred adaptivity. Logging systems can provide fine-grained longitudinal measures of learners' response times and accuracy rates during practice, which are central in a SAT perspective. Further, through learner-centred adaptivity, the conditions of practice can be varied, such as time pressure, type of feedback, or other game elements, which may yield information on how

well specific skills are automatized, and at what point in the learning process such design attributes are best introduced or withdrawn. Reichle (2012) presents ideas on how proceduralization of L2 skills may be coupled with gameplay mechanics. This could be done by requiring players to produce grammatical utterances in speech act types that are essential to a particular game context, such as questioning witnesses in a game set in a court of law, or casting spells in a wizardry game.

A second critical suggestion for research is to investigate transfer of learning. It would not be surprising to observe improvement of skills during focused practice, both in terms of increases in accuracy and in terms of faster response times. The critical question is whether the skill that is practised is relevant for learners' performance in communicative L2 tasks.

Finally, in line with a recommendation by DeKeyser that is now nearly two decades old (1998), we advocate longitudinal and fine-grained experimental research on skill acquisition with mini-games in ecologically valid research settings such as language classrooms and learners' homes. Given the little time there usually is for communicative L2 instruction, teachers are not likely to spend much time on focused practice with mini-games in classrooms, and may therefore choose to relegate practice to contexts outside of class. Consequently, the many design attributes of games supposedly associated with learner motivation may play a mediating role in their L2 development, as these could determine how much time learners spend on practice.

SECTION 6: FURTHER READING

Readers interested in SLA research on focused practice are recommended to read the work of Wong & VanPatten (2003) and DeKeyser (1998). The former paper argues, on the basis of

psycholinguistic research in SLA, that mechanical drills are unnecessary and even disadvantageous for L2 learning. DeKeyser's paper takes a broader perspective on focused practice by pointing at the potential relevance of meaningful and communicative drills, and discusses its history and utility in terms of Skill Acquisition Theory.

Gatbonton & Segalowitz (2005) introduce an instructional design model for focused practice known as Automatization in Communicative Contexts of Essential Speech Segments (ACCESS). The ACCESS model is noteworthy in that it weds communicative L2 teaching methodology with focused practice, rather than alternating between the two. The model leaves scope for mini-games in the 'language consolidation' phase, which is tightly integrated with communicative practice tasks.

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ACKNOWLEDGEMENTS

This contribution was partly realized through interaction with the project *Games Online for Basic Language learning*, funded with support from the European Commission (519136-LLP-2011-NL-KA2-KA2MP). This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.